TECHNICAL SPECIFICATIONS

IDAHO DEPARTMENT OF LANDS
TRIUMPH MINE SITE
DISCHARGE SITE RELOCATION

ISSUED FOR BID/CONSTRUCTION

AUGUST 20, 2008

SPF Water Engineering, LLC
water resource consultants

TRIUMPH MINE DISCHARGE SITE RELOCATION

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DIVISION 1 – GENERAL

1.1 SCOPE OF WORK

A. The project site is located south east of the Lower Tailing's Pile (LTP) of the Triumph Mine Site, which is south east of the town of Triumph, Idaho. The selected contractor will tie into an existing HDPE drainage pipe and relocate the discharge location by adding approximately 580 lineal feet of buried HDPE fused-joint piping. It is assumed the existing piping is SDR 32.5, but the contractor is to verify this by pot holing the tie-in location prior to ordering the pipe. After pot holing the contractor will also verify the elevation of the pipe and compare it to the assumed elevation on the drawing. With assistance from the Engineer, the grade of the pipe will be adjusted if the elevations are different.

The Contractor will have to ensure the existing pipe is dry when fusing onto it with the new pipe. The Contractor shall coordinate with the Owner and supply all labor and material required to isolate the water supplies to the existing discharge line. The line is currently fed from the Surge pond and the Permanent pond outlets. The gates in the Surge pond can be easily closed, but it has been documented that approximately 1 gallon per minute does leak past these gates. The Contractor could possibly plug the inlet or outlet of the weir control structure downstream of the Surge pond outlets. If this isn't possible, the contractor may be able to pump the pond level down below the outlet gates and/or isolate the feed into the Surge pond. If water is flowing out of the Permanent pond, the Contractor may be able to pump the pond level down below the outlet sump or empty the pond. The contractor may also be able to plug the outlet sump. The Contractor may choose to appropriately isolate the supply to the existing discharge line a couple of days prior to making the tie-in (if pre-approved by the Owner) in an attempt to alleviate some of the standing water adjacent to the existing discharge location. The Contractor is encouraged to thoroughly question the Owner about the existing facilities, so a method of isolation is identified by the Contractor prior to completing their bid.

All work shall be performed to avoid disturbing the LTP embankment and will have to comply with the conditions associated with the Army Corp of Engineer's 404 permit. The alignment will be field fit to minimize impact to the vegetation that could be identified as potential wetlands. The limits of disturbance will be a maximum of 30 feet wide along the alignment. The topsoil will be saved and reutilized to promote the re-growth of existing plant material. The Contractor will be required to hydro seed all disturbed areas. The facilities constructed shall include all materials and equipment as shown on the contract drawings and described herein.

1. The selected contractor shall supply all required materials and appurtenances.

2. All outstanding permits and associated construction approvals will be the sole responsibility of the selected contractor.

3. All materials installed during this contract shall be new unless approved by the Engineer and Owner.

1.2 SPECIFICATIONS

A. This document provides technical specifications for the Discharge Site Relocation at the Triumph Mine Site. The specifications contained herein are to be considered supplemental specifications to the current version of the Idaho Standards for Public Works Construction (ISPWC). Any conflicts between these specifications and the ISPWC Specifications shall be brought to the attention of the Engineer. The Engineer will determine which specification is more stringent and shall control.

1.3 QUALITY ASSURANCE

A. The Work performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be completed, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the completion of, and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Owner.

B. All equipment and materials must comply with all applicable standards of.

AASHTO	American Association of State Highway Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
ISPWC	Idaho Standards for Public Works Construction
NEC	National Electrical Code
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety & Health Administration
RSWW	Recommended Standards for Water Works
UBC	Uniform Building Code

1.4 SUBMITTALS

A. Before executing any work in this section the selected contractor shall submit for documentation, job specific selected materials and equipment and all appurtenances as specified in the Contract Documents.

B. Submittals shall include certification that each applicable Section of the appropriate standards listed above have been met. The Engineer must approve any variation from the Contract Documents.

Project Specific Required Submittals five (5) copies of each Shop Drawing Submittal:

- All Piping and fittings
- Pipe bedding material
- Any other items requested by the Engineer

1.5 WARRANTY

A. The warranty period dictated in the agreement between the Owner and the Contractor supersedes the following. If a warranty period is not addressed in this agreement then for a period of one (1) year from the date of substantial completion any work completed under this project or any part thereof shall prove to be defective in installation, material or workmanship the contractor shall warrant replacement or repair to the satisfaction of the Owner at no expense to the Owner.

1.6 PROGRESS OF CONSTRUCTION

A. It is the intention of the Contract Documents that the progress of the work shall proceed in a systematic manner so a minimum of inconvenience will result to the public in the course of construction. Cleanup of all construction debris, excess excavation, excess materials, and complete restoration of all fences, mailboxes, irrigation structures, ditches, culverts, signposts, and similar items shall be completed immediately following the disturbance. The Contractor shall stockpile excavated material so as to do the least damage to adjacent areas or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from adjacent areas, and these surfaces shall be left in a condition equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign material.

B. It is the intent of these Specifications that the Contractor is responsible for any necessary asphalt pavement repair and shall provide all labor and equipment necessary to grade and maintain in a reasonable condition all streets which have been affected by construction until surface repair has been completed.

1.7 STARTUP

A. Furnishing and Installation

1. The Contractor shall provide all tools, supplies, materials, equipment, and labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents.

1.8 INTERFERING STRUCTURES AND UTILITIES

A. The Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether aboveground or underground. Whenever possible, the Owner will attempt to locate its facilities so as to provide a minimum of conflict with existing structures and utilities. While the location of existing structures and utilities will be based upon the best information available, the completeness and accuracy of said information cannot be guaranteed, and it is provided simply as a guide to possible difficulties.

B. It shall be the responsibility of the Contractor to locate and expose all existing underground structures and utilities in advance of excavation. Any structure or utilities damaged by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at the Contractor's expense.

C. The Contractor shall remove and replace such small miscellaneous structures as fences, catch basins, drain pipe, culverts, mailboxes, and signposts at his own expense. The Contractor shall replace these structures in a condition as good, or better than, their original conditions.

D. The Contractor shall remove, protect and replace all drainage ways, all drainage and irrigation structures, or other improvements and similar items located near the proposed improvements at his own expense. Replacement shall be in a manner and in a condition at least equivalent to the original condition.

E. If the Contractor encounters existing structures that interfere with the new facility(ies), he shall notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. The cost of waiting or “down” time during such field revision shall be borne by the Contractor. If the Contractor shall fail to so notify the Engineer when an existing structure is encountered, but shall proceed with the construction despite this interference, he shall do so at his own risk. In particular, when the location of the new construction, as shown on the Plans, will prohibit the restoration of existing structures to their original conditions, he shall notify the Engineer so field relocation may be made to avoid the conflict.

1.9 AS-BUILT DRAWINGS

A. The Contractor will be required to furnish one red-lined set of as-built revisions on the construction drawings, indicating the exact location of all facilities installed. As-built drawings completed by the Contractor and approved by the Engineer or his representative shall be submitted prior to acceptance of the project by the Owner.

1.10 FIELD RELOCATION

A. During the progress of construction, it is possible that minor relocations may be necessary. Such relocations shall be made only by direction of the Engineer or his representative.

1.11 PUBLIC SAFETY AND CONVENIENCE

A. The Contractor shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets or highways to the use of public traffic. No road shall be closed by the Contractor to the public except by express permission of the Engineer. Traffic must be kept open on roads and streets where a detour is impossible. The Contractor shall, at all times, conduct his work so as to assure the least possible obstruction to traffic and normal commercial pursuits. All obstructions within traveled roadways shall be protected by approved signs, barricades, and lights where necessary or ordered by the Engineer or his representative for the safety of the traveling public. The convenience of the general public and the protection of persons and property are of prime importance and shall be provided for by the Contractor in an adequate and satisfactory manner.

B. The Contractor shall use every reasonable precaution to safeguard the persons and property of the traveling public. Failure of the Engineer or his representative to notify the Contractor to maintain barricades, barriers, lights, flares, danger signals, or watchmen shall not relieve the Contractor from his responsibility. All barricades and obstructions shall be protected at night by signal lights, which shall be suitably distributed across the roadway or alleyway and kept burning from sunset to sunrise.

C. Whenever the Contractor's operations create a hazardous condition, he shall furnish flagmen and guards as necessary or as ordered by the Engineer or his representative to give adequate warning to the public of any dangerous conditions to be encountered. He shall furnish, erect, and maintain approved fences, barricades, lights, signs, and any other devices that may be necessary to prevent accidents and to avoid damage and injury to the public. Flagmen and guards while on duty and assigned to give warning to the public, shall be equipped with appropriate wearing apparel and flagging that shall be kept clean and in good repair.

1.12 EASEMENTS AND PERMITS

A. Portions of the project may be located on private property. The Owner will obtain easements and permits. Easements shall provide use of property for construction purposes to the extent indicated on the easements. Copies of these easements and permits will be available at the office of the Owner for inspection by the Contractor. The Contractor shall confine his construction operations to within the easement limits or designated limits of disturbance on the construction drawings. Any damage to private property, either inside or outside the limits of the easements provided by the Owner, shall be the responsibility of the Contractor.

1.13 LAND MONUMENTS

A. The Contractor shall preserve existing City, County, State, and Federal land monuments wherever possible. When these monuments cannot be preserved, the Contractor shall notify the Engineer or his representative at least forty-eight (48) hours in advance of the proposed construction in order that the Engineer will have ample opportunity to reference these monuments for later replacement.

1.14

FINAL CLEANUP

A. After completion of all Work associated with this contract, the Contractor shall clean up the Work site and any property used by his operations to the satisfaction of the Owner and Engineer. The Contractor shall remove and dispose of all excess materials resulting from his Work, and shall repair, replace, or restore all property of any type or nature which has been moved, damaged, or altered in any way by his operations, to the satisfaction of the Owner and Engineer.

- END OF GENERAL -

SECTION 02100
TRENCHING AND BACKFILL

PART 1 -- GENERAL

1.1 This section covers the work necessary for trench excavation and backfill, including but not limited to clearing the alignment; protection of private property during construction; legal disposal of cleared materials, excavation of the trench for pipe and appurtenances; foundation stabilization; trench backfill of the types required, removal, replacement and rehabilitation of all drainage and irrigation ditches, waterways, or other features moved or damaged during the construction; removal of all obstructions; removal of existing pavement; locating and protecting existing utilities; the maintenance of access to public thoroughfares and to private property; the maintenance of adequate barricades, lights, and warning signs for the protection of the public on city streets, alleys, public highways, county roads, and private drives, shoring, cribbing, bracing, and dewatering as may be required, hauling and legal disposal of waste excavation, including temporary hauling and disposal of spoil which cannot be accommodated within the designated alignment, repair of public and private property damaged during construction; final cleanup of the construction areas, and all miscellaneous items of work required to complete the construction as specified hereunder.

PART 2 -- PRODUCTS

2.1 BEDDING MATERIALS

A. **Type III Pipe Bedding Material.** Pipe bedding material shall be sand with 100% passing the No. 4 sieve and less than 3% passing the No. 200 sieve. Type III should be used on a stable subgrade. All pipe-bedding materials shall be submitted for the Engineer's approval prior to utilization.

B. **Type II Aggregate Material.** Use for Foundation Stabilization meeting the following gradation: 3 inch – 100% passing, No. 4 – 25-60% passing, and No. 100 – 0-12% passing.

2.2 BACKFILL MATERIALS

A. **Initial Backfill Material.** Initial backfill material in the pipe zone shall be the same material utilized for pipe bedding. See the standard drawings for further installation information.

B. **Native Backfill.** After initial backfill, trenches may be backfilled with the material excavated provided rocks of over four (4) inches maximum dimension and other deleterious material if present in the excavated material are removed. Material containing frost shall not be used for backfill. The depth of the native backfill zone will depend on the depth of trench and the available amount of native topsoil available. Native topsoil will be maximized and the native backfill zone will be minimized.

C. **Native Topsoil.** During trench excavation, the Contractor shall separate the excavated topsoil material from the other subsoils and save it for reuse. The topsoil shall be replaced after the pipeline and non-organic native backfill is installed. The organic topsoil zone should be of a depth to fully utilize the available topsoil. Due to shallow

trench depths, there may be areas where the native topsoil is placed directly on the initial backfill material.

PART 3 -- EXECUTION

3.1 MATERIALS

A. **Common Excavation.** The excavation required under these Specifications shall be classified as common excavation. Construction materials and equipment used for the work to meet all requirements of the Contract Documents.

B. **Water for Backfill.** It will be the Contractor's responsibility to make all necessary arrangements for a source of water during all periods of construction and to make all arrangements for the delivery of the water to the trench site.

3.2 WORKMANSHIP

A. **General.** All trench excavation and backfill shall conform to the Specifications of any controlling regulating agency under which the work is being performed. Any item of trench excavation and backfill not covered by the specifications of a regulating agency, or by these Specifications, shall conform to the applicable AWWA Specification.

B. **Clearing the Alignment.** Where clearing of the pipeline alignment is necessary, it shall be completed prior to the start of the trenching. Brush shall be cut as near to the surface of the ground as practicable and piled for removal. Under no conditions shall excavated materials be permitted to cover brush prior to clearing and disposal of same.

C. **Obstructions.** This item shall refer to obstructions, which may be removed and do not require replacement. Obstructions to the trench such as, but not limited to, tree roots, stumps, abandoned concrete structures and debris of all types shall be removed by the Contractor at his own expense.

D. **Alignment and Grade**. Trench excavation shall be to the required alignment as shown on the plans or as directed by the Engineer. Grade for the top of the pipe shall be a minimum of one foot below the finished ground elevation. Accurately grade the bottom of the trench to the lines and grades indicated in the Contract Documents. Confine the construction operations to a maximum width of 30 feet along the alignment, minimizing disturbance to potential wetland areas.

E. **Excavation Methods.** The contractor shall use excavating equipment that is appropriately sized for the work described in the Contract Documents. Oversized equipment should be avoided in an effort to minimize the amount of disturbed potential wetland area.

F. **Location of Excavated Materials**. During trench excavation, the Contractor shall separate the excavated topsoil material from the other subsoils. The topsoil shall be replaced after the pipeline and non-organic backfill is installed. All excavated material suitable for backfill shall be placed a sufficient distance from the banks of the trench and in accordance with OSHA.

G. **Removal of Water.** The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the

laying of the pipe, and until the backfill at the pipe zone has been completed. Water removal shall be done in a manner that does not damage adjacent property or enter adjacent waterways. Pumps shall be monitored continuously during periods when personnel are in the trench excavation. Contractor is responsible for acquiring all appropriate approvals and permits associated with dewatering activities and its discharge.

H. **Preparation of the Trench Bottom.** Pipe shall be laid on bedding per the trench detail drawing and provide continuous contact with the pipe. If the trench bottom (subgrade) is disturbed during excavation, compact to 92% maximum density as measured by AASHTO T99 prior to placement of bedding or foundation stabilization material. Compact bedding sand to the same requirement.

I. **Foundation Stabilization.** The pipe shall be laid on stable soil. Unstable material that will not uniformly support the pipe should be excavated to a depth that will allow adequate support of the pipe. Any part of the trench excavated below neat line grade shall be backfilled to grade with thoroughly compacted (maximum of 6 inch lifts) Type II aggregate material. If the trench bottom (subgrade) is disturbed during excavation, compact to 92% maximum density as measured by AASHTO T99 prior to placement of foundation stabilization material.

J. **Initial Backfill.** After the pipe lengths have been fused and placed on the bedding material, the sides of the pipe shall be carefully backfilled with bedding sand to a depth of 6 inches above the pipe and thoroughly compacted to 92% of the maximum density as measured by AASHTO T99 utilizing an approved method of tamping.

1. Tamping in the initial backfill zone shall be accomplished with stand-up, walk-behind, mechanical compaction equipment (jumping jack). Care should be taken not to damage the pipe with the equipment.

K. **Native and Native Topsoil Backfill.** The initial backfill zone shall be compacted as required previously. The balance of the trench backfill shall be compacted by placing the backfill material in layers not to exceed eight (8) to twelve (12) inches in thickness and compacting said layers with mechanical compaction equipment to at least ninety-two (92) percent of the maximum density as determined by AASHO Method T-99. This method of backfill and compaction shall be utilized to bring the trench backfill to the original ground surface.

- END OF TRENCHING AND BACKFILL -

SECTION 02718

HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services necessary for the installation of all high density polyethylene (HDPE) pipes, pipe fittings, and appurtenances required for construction. The work shall be carried out in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals.

B. Section 02100 – Trenching and Backfill.

1.3 REFERENCES

A. The material and Work furnished shall be, as a minimum, in accordance with the latest editions of the following standards except as such Standards are modified and supplemented in this section.

1. American Society for Testing and Materials (ASTM):

Referenced Standards

Reference	Title
ASTM D638	Test Method for Tensile Properties of Plastics
ASTM D790	Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 1239	Test Method for Flow Rates of Thermal Plastics by Extrusion Plastometer
ASTM D 1248	Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D1505	Test Method for Density of Plastics by the Density Gradient Technique
ASTM D1599	Test Method for Short Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings
ASTM D1693	Test Method for Environmental Stress Cracking of Ethylene Plastics
ASTM D2122	Method for Determining Dimensions of Thermal Plastic Pipe and Fittings

ASTM D2837	Method for obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials
ASTM D3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
ASTM D3350	Specification for Polyethylene Plastics Pipe and Fittings Material
ASTM D4219	Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM F1248	Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe
ASTM F714	Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter

2. American Water Works Association (AWWA):

Reference	Title
AWW A C906-90	Polyethylene Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution

1.4 CONTRACTOR SUBMITTALS

A. Shop drawings and sample submittals shall be in accordance with Section 01300 - Contractor Submittals, the following documents shall be submitted to the Engineer for review and acceptance:

1. Detailed pipe information showing the Standard Dimension Ratio (SDR) and wall thickness of pipe and clean-out fittings. A detailed fabrication drawing should be supplied for the clean-out fittings.

2. Current butt-fusion welding procedures and certified welder qualification records for all personnel assigned to this portion of the Contract.

3. Copies of all manufacturer-supplied literature and documentation.

4. Proposed layout and method for connecting the new pipe to the existing.

1.5 QUALITY CONTROL

A. The Contractor shall have demonstrated and proven methods and procedures to assure that items and services, including subcontracted items and services, comply with this Specification section. These methods and procedures shall be submitted to, and shall be subject to review by the Engineer.

B. Fabrication, processing, testing and inspection operations affecting the pipe and associated accessories shall, at any time, be subject to quality assurance surveillance by Owner or Engineer. Such surveillance shall be at the discretion of the Owner. Such surveillance does not relieve the Contractor from responsibility for the Work.

C. The Contractor shall submit to the Engineer for approval within 7 days prior to the start of pipe work a complete list of materials to be furnished and the name of the pipe Manufacturer.

D. The Contractor shall submit to the Engineer the pipe Manufacturer's certification of compliance with the product requirements of Part 2 of this section, including certification that stress regression testing has been performed in accordance with ASTM- D 2837 on the pipe products representative of that delivered to the site. The Manufacturer's Certification must be based on a QC testing frequency of one sample per lot.

E. The Contractor shall submit to the Engineer in writing the following documentation from the pipe Manufacturer on the raw materials used to manufacture the pipe and fittings.

1. Certificate identifying the specific resin used, its source, and the information required by ASTM D 1248.

2. Certificate stating that no recycled resin was used in manufacturing the pipe except for a small percentage (15 percent or less) of resin generated in the pipe Manufacturer's own plant from production using the same resin as the recycled material.

F. All Quality Control testing required by these Specifications and/or conducted at the discretion of the Contractor shall be the responsibility of the Contractor.

1.6 LABELING

A. The following shall be continuously indent-printed on the polyethylene pipe, or spaced at intervals not exceeding 10 feet:

1. Name and/or trademark of the pipe Manufacturer.

2. Outside pipe diameter.

3. Standard dimension ratio (SDR).

4. The letters PE followed by the polyethylene grade per ASTM D 1248, followed by the hydrostatic design stress in 100’s of psi (i.e., PE 3408).

5. Manufacturing Standard Reference (e.g., ASTM F 714-1).

6. A production code from which the date and place of manufacturer can be determined.

PART 2 -- PRODUCTS

2.1 HDPE RESIN PROPERTIES

A. The HDPE pipe and fittings shall be manufactured from new, high molecular weight, HDPE resin conforming to ASTM D1248 (Type III, Class C Category 5, Grade P 34), ASTM D3350 (Cell Classification PE 345434C), and having a Plastic Pipe Institute (ppl) Rating of PE 3408. The resin shall be pre-compounded. In plant blending of non-compounded resins shall not be permitted. Pipe and fittings shall be manufactured from the same resin and by the same manufacturer.

B. The polyethylene compound shall contain a minimum of 2 percent carbon black to withstand outdoor exposure without loss of properties.

C. The polyethylene compound shall have minimum resistance of 5,000 hours when tested for environmental stress crack in accordance with requirements of GRI-GM5.

2.2 HDPE PIPE AND FITTINGS PROPERTIES

A. The Contractor shall provide pipe having the outside diameters shown on the Construction Drawings.

B. All HDPE pipe and fittings shall have a minimum Standard Dimension Ratio (SDR) of 32.5 or as necessary to match the existing pipe that it is being connected to.

C. All HDPE pipe and fittings shall have a minimum hydrostatic design basis of 1,600 pounds per square inch when determined in accordance with ASTM D 2837 unless otherwise indicated on the Construction Drawings.

D. All HDPE pipes and fittings shall comply with AWWA C-906.

E. HDPE pipe shall be supplied in standard laying lengths not exceeding 50 feet.

F. HDPE pipes and fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious effects, and shall be uniform in color, density, melt index, and other physical properties.

G. The material must exceed 1,000 hours with fewer than 50% failures when tested in accordance with the Environmental Stress Crack Resistance Test ASTM (F1248).

H. Special Fittings and Adapters: All special fittings and adapters shall be designed and manufactured according to the requirements specified on the Drawings.

2.3 JOINTS

A. All HDPE to HDPE pipe joints shall be constructed using butt fusion techniques. All steel fittings and appurtenances (if required) shall be joined to HDPE pipe and fittings using flanged connections with rubber gaskets and ductile iron backup rings, all in conformance with AWWA C906-90 standards. Bolt patterns shall meet ANSI B16.1 requirements.

PART 3 -- EXECUTION

3.1 FABRICATION

A. Pipe shall be homogeneous throughout and uniform in color, opacity, density, and other properties as prescribed in the Resin Manufacturer's Specifications. The inside and outside surfaces shall be semi-matte to glossy in appearance and free from sticky or tacky material. The pipe walls shall be free from cuts, cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity.

B. Pipe shall be finished smooth throughout all inside surfaces and true to all specified tolerances for circumference and diameter such that: The difference between maximum

and minimum diameters, at any cross section along the length of the pipe, does not exceed 1% of the nominal diameter.

C. Special pipe sections, fittings, and special pieces shall be completely fabricated in the shop. All pipe fittings shall be fabricated or molded to correct dimensions throughout the entire length. End cuts shall be clean, squarely-made, and suitable for field welding, without drawn, ragged, gouged, or split edges.

D. Pipe dimensions and wall thickness variations shall be in conformance with requirements of AWWA C906-90.

E. E. All butt-fusion joints shall be watertight under the maximum internal pressure.

F. All fittings, unless noted otherwise on the Drawings, shall be fabricated in conformance with the requirements of AWWA C906-90. Quick burst and five-second pressure tests are not required. Molded fittings shall meet the requirements of ASTM D3261 for butt-type fittings and this specification.

3.2 TRANSPORTATION

A. Transportation of polyethylene pipe and fittings shall be the responsibility of the Contractor. The Contractor shall be liable for all damage to the polyethylene pipe and fittings incurred prior to and during transportation to the site.

3.3 HANDLING AND STORAGE

A. Handling, storage, and care of the polyethylene pipe and fittings, prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the material incurred prior to final acceptance by the Owner.

B. The Contractor shall be responsible for storage of polyethylene pipe and fittings at the site. Pipe and fittings shall be stored on clean level ground free of sharp objects which could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipe under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers that are spaced suitably and of such width as not to allow deformation of the pipe. The pipe shall be stored to minimize bowing.

C. The Contractor shall exercise care when transporting, handling and placing pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

D. The Contractor shall comply with the pipe Manufacturer's recommendations for handling, storage, and installation of all polyethylene pipe fittings.

E. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe.

F. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

G. Pipe fittings shall not be dropped onto rocky or unprepared ground. The pipe and fittings shall not be dropped into trenches or dragged over sharp objects.

H. The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings

shall be free of cuts, gouges and scratches. The Engineer will inspect the pipes. Sections of pipe with excessive cuts, gouges, or scratches will be rejected and the Contractor will be required to remove and replace the rejected pipe, at no additional cost to the Owner.

I. No construction vehicles shall be permitted to travel over the pipe unless a minimum 2 feet of compacted backfill has been placed over the top of the pipe.

3.4 INSTALLATION

A. All pipe and fittings shall be installed in accordance with these Specifications and the pipe Manufacturer's instructions.

B. Trenching and backfill operations shall be performed in accordance with the requirements of Section 02100-Trenching and Backfill.

C. The Contractor shall carefully examine all pipe and fittings for cracks, damage or defect before installation. Defective materials shall be removed from the site and replaced with non-defective material at no additional cost to the Owner.

D. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

E. Field cutting of pipe shall be carefully made using an approved mechanical cutter, without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. The method and device used to cut the pipes shall be approved of by the Owner. Sharp edges of cut ends shall be filed off smooth.

F. All pipe and fittings shall be laid or placed to the grades and elevations shown on the Construction Drawings with bedding and backfill as shown on the Construction Drawings and Specifications.

G. Blocking under piping shall not be permitted unless specifically accepted by the Owner.

H. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

I. Clean all piping as required to remove all foreign materials including dirt, grease, and other matter. Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

J. During pipe installation, the trench bottom shall be kept free of frost, frozen earth, or standing water. The Contractor shall maintain the trench in good condition at all times to prevent caving.

3.5 JOINING METHODS

A. HDPE pipe shall be joined with thermal butt-fusion joints. Pipeline field joints will be spaced at approximately 50 feet for straight runs of pipe. All joints shall be made in accordance with ASTM D 2657 and the pipe Manufacturer's recommendations, and shall be made by trained personnel authorized by the pipe Manufacturer.

1. All butt fusion welders and welding operators shall be qualified and certified for all portions of the work specified in this Section. Welder qualification requires that, during the past 12 months, all welders and welding operators have successfully completed certified butt-fusion joints using the pipe and welding machine proposed for this project.

3.6 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect all materials and all partially - complete and completed work of these Specifications.

B. In the event of damage, the Contractor shall make all repairs and replacements necessary, to the approval of the Engineer and at no additional cost to the Owner.

3.7 ACCEPTANCE TESTING

A. **General.** Provide all test equipment and material, including test pumps, gages, water, volumetric measuring equipment, and other equipment required. Pressure gages used shall be graduated in increments appropriate for the test pressure, but not greater than 5 psi and shall have range of approximately twice test pressure. Use only calibrated gages and instruments. Provide calibration certificates.

B. **Test Pressure.** This drainage pipe shall be hydrostatically tested by filling the new and existing line with water and visually observing the performance of the butt fused joints. Water level should be filled to the lowest inlet elevation (that of the permanent pond) in the existing piping or to 10 psi, whichever is lower. Contractor to maintain the pressure by adding water to the system throughout the duration of the test.

1. Test with piping in final location. Pipeline can be partially backfilled, but all joints and fittings need to be exposed for visual inspection.

2. Hold test pressure for a minimum of 4 hours. Test time will be accrued only while full test pressure is applied to system.

3. The Contractor shall be responsible for providing all temporary fittings, plugs, and thrust blocking for all testing at the specified pressure. The contractor will provide a temporary flange adapter with a blind flange at the end of the pipe. The flange adapter will be removed after the test is successfully completed.

4. Visual leakage shall be zero for the piping at the specified test pressure throughout the specified duration.

- END OF SECTION -

APPENDIX A

EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMP’s)

Preservation of Existing Vegetation BMP 3

Description

Protect existing vegetation (including trees, grasses, and other plants) by preventing disturbance or damage to specified areas of a construction site or right-of-way. Preserving natural vegetation provides buffer zones and stabilized areas, which help control erosion, protect water quality, and enhance aesthetic benefits. This practice minimizes the amount of bare soil exposed to erosive forces.

Applications

This technique is applicable to all types of sites. Areas where preserving vegetation can be particularly beneficial are floodplains, wetlands, stream banks, steep slopes, and other areas where other structural erosion controls would be difficult to establish, install, or maintain. Compared to newly planted or seeded areas, preserving natural vegetation has many advantages:

- It can handle higher quantities of stormwater runoff than newly seeded areas.
- It does not require time to establish (it is effective immediately).
- It has greater filtering capacity because the vegetation and root structure are usually denser in preserved natural vegetation than in newly seeded or base areas.
- It usually requires less maintenance, watering, and chemical application (e.g., fertilizer, pesticides) than planting new vegetation.

It also:

- Enhances aesthetics.
- Provides areas for infiltration, thus reducing the quantity and velocity of stormwater runoff.
- Allows areas where wildlife can remain undisturbed.
- Provides noise buffers and screens for on-site operations.

Limitations

Drainage area - unlimited
Minimum bedrock depth - N/A
NRCS soil type - ABCD
Drainage/flood control – no
Maximum slope – unlimited
Minimum water table - N/A
Freeze/thaw – good

Preservation of natural vegetation may be impractical in some situations because:

- It may constrict the area available for construction activities.
- It may not be cost-effective in areas with high land values.

Targeted Pollutants

Sediment

Design Parameters

- Successful preservation of vegetation requires good planning and site management to minimize the impact of construction activities on existing vegetation. The areas to be preserved should be identified in the plans and clearly marked in the field before any site disturbance begins. Clearly mark all trees to be preserved, and protect against ground disturbance within the dripline of each marked tree.

The dripline marks the edge of the tree's foliage where drips from rainfall would drop. Most of the tree's roots lie within the dripline and are vulnerable to damage.

- Preserving natural vegetation may affect some aspects of staging, work sequencing, and construction cost. In addition, control measures may be needed around the perimeter of the preserved area to maintain adequate water flow and drainage and to prevent damage from excessive erosion or sedimentation. Be sure to consider these and related factors when preparing the project site plan and project cost estimates.
- Consider the use of design exceptions to enable preservation of natural vegetation in certain areas where it would typically be removed and where its preservation would not pose safety problems.

Construction Guidelines

- Check the project plans for areas designated for preservation of natural vegetation. Keep all construction equipment, materials, and waste out of the designated areas.
- Do not modify existing drainage patterns through or into any preservation area unless specifically directed by the plans or approved by the local permitting authority.
- Perform maintenance activities as needed to ensure that the vegetation remains healthy and able to aid in erosion control and sediment collection.

Maintenance

Inspect at regular intervals to make sure the preserved vegetated areas remain undisturbed and are not being overwhelmed by sediment. Implement maintenance or restorative actions as needed. Proper maintenance is important to ensure healthy vegetation that can control erosion. Different species, soil types, and climatic conditions will require different maintenance activities such as mowing. Maintenance should be performed regularly, especially during construction.

Clearing Limits BMP 4

Description

Minimize the total amount of bare soil exposed to erosive forces by (1) controlling the amount of ground that is cleared and grubbed at one time in preparation for construction, and (2) limiting the amount of time that bare ground may remain exposed before slope protection or stabilization measures are put into place. This measure, in conjunction with appropriate timing (avoiding the rainy season), can reduce erosion and sedimentation.

Applications

Any areas where vegetation should be removed to facilitate construction. This practice should be a design consideration of all projects. It may be necessary to carefully coordinate land clearing, grading, and erosion control measures--see BMP 1-Timing of Construction.

Limitations

Drainage area - unlimited
Minimum bedrock depth - N/A
NRCS soil type - ABCD
Drainage/flood control – no
Maximum slope – unlimited
Minimum water table - N/A
Freeze/thaw – good

Targeted Pollutants

Sediment

Design Parameters

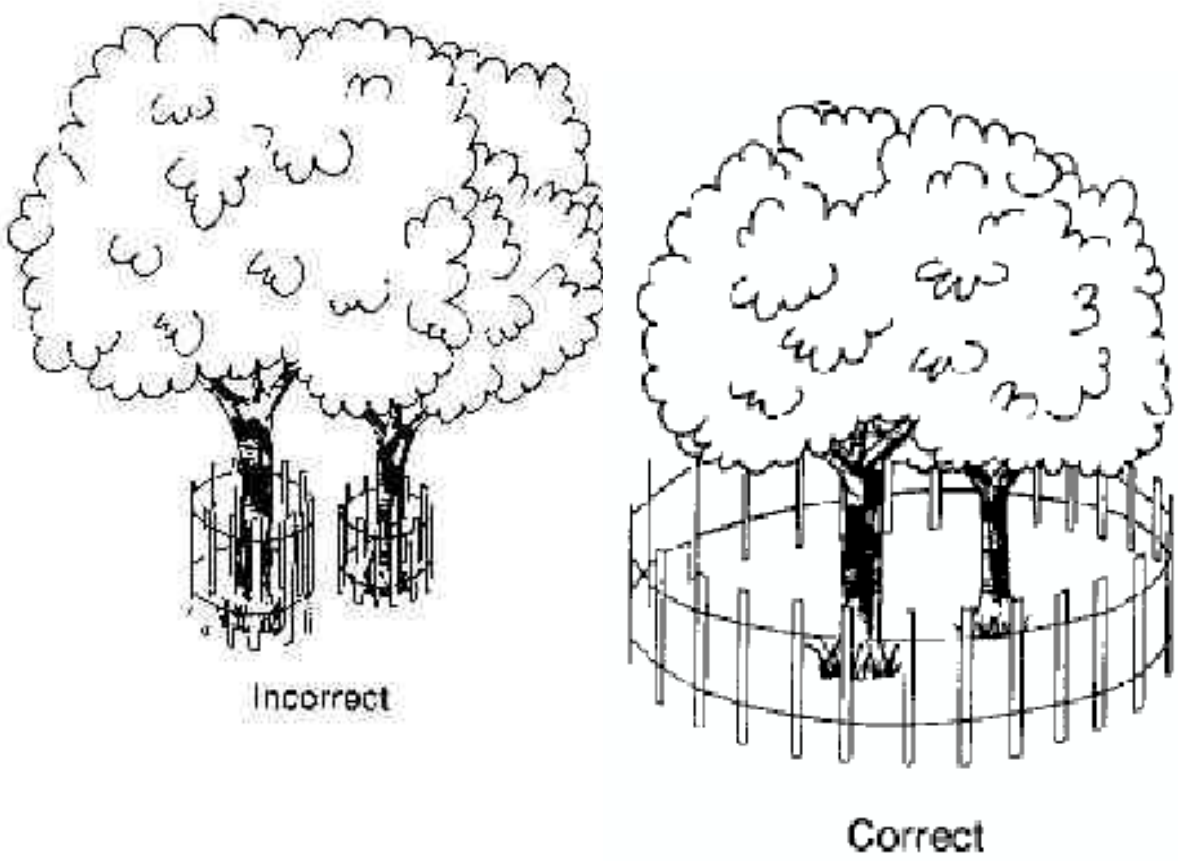
- Evaluate the erosion potential of the project site (based on slope, soil type, intended season of work, use of heavy equipment).
- Based on the above analysis, establish the maximum allowable area that may be exposed at one time. The project site plan should clearly specify the maximum allowable exposure area.
- Initiate slope protection and reclamation as work progresses to help minimize the amount of disturbed soil.
- In all cases, stabilization measures should be initiated within 14 days after ceasing work in a given area or as soon as practicable during seasonally arid periods.

Construction Guidelines

- Do not disturb any areas that are not actually needed for the specified construction or related staging activities. See BMP 3-Preservation of Existing Vegetation.
- Conduct work in units or stages so that construction and stabilization take place promptly after clearing and grubbing and as much of the site as possible is ready for seeding each time the specified seeding season arrives.
- Implement soil stabilization measures concurrently with the progress of clearing and grading work to minimize the length of time that bare ground lies exposed to erosion.
- At the approach of a designated seeding season, be prepared to seed all portions of the project that are ready for seeding (as required).

Maintenance

Conduct periodic inspections to check for unnecessary ground disturbance. Also check for clearing and grubbing beyond the contractor's capability and progress in keeping grading and pollution control measures current (in accordance with accepted work schedule).



Barrier should be installed at the drip line of tree branches.

Dust Control BMP 7

Description

This BMP describes products or measures used for reducing or preventing wind erosion by protecting the soil surface, roughening the surface, and reducing the surface wind velocity. Several dust control treatments are described below. Other methods are also available.

Vegetative Cover: For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (see BMP 21-Seeding and BMP 22-Sodding).

Mulch (including gravel mulch): When properly applied, mulch offers a fast, effective means of controlling dust (see BMP 15-Mulching).

Spray-On Adhesive: Asphalt emulsions, latex emulsions, or resin in water can be sprayed onto mineral soil to control dust (see BMP 16-Hydromulching).

Sprinkling: The site may be sprinkled with water until the surface is wet. Sprinkling is especially effective for dust control on haul roads and other traffic routes.

Stone: Stone or gravel used to stabilize construction roads and disturbed soils can also be effective for dust control and reduce soil losses from those areas by up to 80% .

Surface Roughening: Tilling or discing the surface of disturbed soils to produce a rough surface or ridges which when perpendicular to prevailing winds can reduce soil losses due to wind by 80% (see BMP 25-Slope Roughening).

Barriers: A board fence, wind fence, sediment fence, or similar barrier can control air currents and blowing soil. All of these fences are normally constructed of wood. Perennial grass and stands of existing trees may also serve as wind barriers. Barriers prevent erosion by obstructing the wind near the ground and preventing the soil from blowing off site.

Applications

The above measures for dust control should be used when open, dry areas of soil are anticipated on the site. Clearing and grading activities create the opportunity for large amounts of dust to become airborne. Therefore, one or several dust control measures should be considered prior to clearing and grading. In many cases, water erosion control measures incorporated into the project will indirectly prevent wind erosion. As a standard practice, any exposed area should be stabilized using vegetation to prevent both wind and water erosion. When rainfall is insufficient to establish vegetative cover, mulching is an effective way of conserving moisture, preventing surface crusting, reducing

runoff and erosion, and helping to establish vegetation. It is a critical treatment on sites with erosive slopes.

Limitations

Drainage area – N/A
Minimum bedrock depth – N/A
NRCS soil type – N/A
Drainage/flood control – no
Maximum slope – 5%
Minimum water table - N/A
Freeze/thaw – N/A

Vegetative measures may not be practical during dry periods unless a reliable supply of establishment water is available. Other methods should be stipulated in the project contract to ensure that dust control is not overlooked.
Barriers (such as walls or fences) can be part of the long-term dust control strategy in arid and semiarid areas, but they are not a substitute for permanent stabilization.

Targeted Pollutants

Sediment
Trace Metals
Hydrocarbons

Design Parameters

Dust Prevention: The best method of controlling dust is to prevent dust production. This can best be accomplished by limiting the amount of bare soil exposed at one time. In project design, identify all areas where ground disturbance will not be allowed. Design and locate haul roads, detours, and staging areas to avoid unnecessary exposure of bare ground and avoid using areas that are the most susceptible to wind erosion.

In the stormwater site plan, specify staging or work sequencing techniques that minimize the risk of wind erosion from bare soil. In most cases, this will require a change from traditional construction techniques that allow large areas to be disturbed at the outset of construction and to remain exposed for long periods of time.

Vegetative Cover: Follow recommended seeding and planting specifications. If site conditions are favorable, use an extended seeding season to ensure that seeding becomes established over as much of the project as possible before winter shutdown or substantial completion. Specify the use of establishment water to accelerate vegetative stabilization if other means of long-term slope protection are not feasible.

Mulch: Apply according to the design parameter for BMP 16-Hydromulching.

Sprinkling: Apply at a rate of 3 gallons per acre so that the soil is wet but not saturated or muddy and so that no dust is being generated.

Stone: At ingress/egress to public highways, apply as indicated in BMP 5-Stabilization of Construction Entrance. For detours, haul roads, or temporary traffic routes through the construction site, provide a layer of fractured stone 2

to 4 in. thick and 1 to 2 in. in diameter.

Surface Roughening: Tilling or discing should leave 6 in. (minimum) furrows, preferably perpendicular to the prevailing wind direction, to gain the greatest reduction in wind erosion. If the surface cannot be furrowed perpendicular to the prevailing wind direction, roughening the surface by using a ripper/scarifier (grader) or a ripper (cat) will produce the desired result of a 6 in. irregular surface.

Barriers: A wind barrier generally protects soil downwind for a distance of 10 times the height of the barrier. If additional protection is needed, use other methods in conjunction with the barrier.

Construction Guidelines

Site Assessment: Assess the potential problem of wind erosion and dust generation at the project site. Consider the soil type, prevailing wind direction, and the effect of other prescribed erosion control measures.

Use Preventive Strategies Wherever Possible:

- Minimize amount of bare ground exposed at one time.
- Minimize amount of ground disturbance occurring when wind erosion is highest.

Implement Dust Control Measures as Needed:

- Provide stabilized roadway to minimize amount of dust generated by construction vehicles and highway traffic (gravel, pave, or moisten the bare areas of the highway or detour route).
- Apply protective materials to exposed areas (e.g., stone, mulch, adhesive/ emulsions).
- Install barriers to prevent dust from blowing off site.
- Establish vegetation at the earliest possible opportunity (using establishment water if necessary to ensure viability).
- Keep haul roads, detours, and other bare areas moist by sprinkling them with water.
- Perform street sweeping, as needed.

Maintenance

- Dust control requires constant attention: it is not a one-time or once-in-awhile activity. Dust control sprinkling may have to be done several times a day during hot, dry weather.
- Areas protected by mulch, adhesive emulsions, or barriers need to be checked at regular intervals according to the inspection schedule set forth in the stormwater plan. Remove sediments that accumulate behind any sediment fence or barrier when the accumulation reaches one half the height of the barrier. Dispose of the sediments only in an approved location (not in wetlands or where they will contribute to pollution at the disposal site).

Apply chemical controls (emulsions and resins) at the manufacturer's specified rates and in accordance with all federal, state, and local regulations governing their use. Chemical products should be stored, handled, and disposed of in accordance with all applicable regulations and department policies.

Hydromulching BMP 16

Description

Hydraulic mulching (hydromulching) is a process where wood fiber mulch, processed grass, hay, or straw mulch are applied with a tacking agent in a slurry with water to provide temporary stabilization of bare slopes or other bare areas. This mulching method provides uniform, economical slope protection. It may be combined with hydroseeding as a revegetation method (see BMP 21-Seeding).

Applications

Hydromulching is an effective way to increase water retention (thereby reducing erosion) for 6 months or up to 1 year. Beyond 1 year, the effectiveness drops off. Hydraulic mulching can be applied to areas that are within about 200 ft of a road or that can otherwise be reached by truck. Small roadside slopes and large, relatively flat areas are well adapted to this method. When adequate moisture exists, the slurry can be combined with seed and fertilizer to initiate stabilization and revegetation in a single application (see BMP 3-Preservation of Existing Vegetation). The mulch usually lasts about 1 year. The growing vegetation is needed to provide continued stabilization.

Limitations

Drainage area – 2 ac.
Minimum bedrock depth - N/A
NRCS soil type - ABCD
Drainage/flood control – no
Maximum slope – 15%
Minimum water table - N/A
Freeze/thaw – fair

- Loses effectiveness after 1 year.
- Only suited for physically stable slopes (at natural angle of repose, or less).
- Avoid hydromulching on long uninterrupted slopes. Break up concentrated flows with other BMPs, such as BMP 26-Gradient Terracing or BMP 32-Check Dams.

Targeted Pollutants

Sediment
Phosphorus

Design Parameters

Effectiveness: Hydromulching initially reduces sediment generation by 70 to 80% as compared to sediment production off bare slopes. Within 2 years, the breakdown of wood fiber will have reduced its effectiveness to 40 to 60%. Beyond that time, only 10 to 30% effectiveness can be expected, and the mulch should be replaced. Nutrient generation is typically reduced 50 to 70% for 6 months, 20 to 50 percent up to 2 years, and 0 to 10% beyond 2 years.

Equipment: The hydraulic mulching machine should be equipped with a gear-driven pump and a paddle agitator. Agitation by recirculation from the pump is not acceptable. Agitation should be sufficient to produce homogeneous slurry of tacking agent and mulch (and seed fertilizer, if used).

Application rates: Apply the water at a minimum rate of 3000 gallons per

acre. Tacking agent should be applied at 28.5 ft^3 of wet ingredients per acre. When seeding is combined with hydraulic mulching, be sure to include an appropriate specified formulation at the specified rate. Legume seeds should be pellet inoculated with the appropriate bacteria. Inoculation rates should be four times that required for dry seeding.

Construction Guidelines

- The time allowed between placement of seed in the hydraulic mulcher and the emptying of the hydraulic mulcher tank should not exceed 30 minutes.
- Wood fiber may be dyed to aid in uniform placement. Dyes should not stain concrete or painted surfaces nor injure plant or animal life when applied at the manufacturer's recommended rate.
- Application of the slurry should proceed until a uniform cover is achieved. The applicator should not be directed at one location for too long a period of time or the applied water will cause erosion.

Maintenance

Hydromulched slopes should be inspected periodically for damage due to wind, water, or human disturbance. Repair all damaged areas immediately using hydromulching at the original specifications or straw mulch.

Seeding BMP 21

Description

Permanent Seeding means growing a long-term or permanent vegetative cover (plants) on disturbed areas or areas that need assistance in revegetation. The purpose of permanent seeding is to reduce erosion and sedimentation and to establish desirable competitive ground cover for wildlife habitat and ease of roadside maintenance. This practice uses prescribed perennial grasses, legumes and native shrubs or wild flowers that will hold the soils, reduce stormwater runoff and act as a bio-filtering system on long-term basis.

The guidelines given in this fact sheet for design, construction and maintenance can also be used to install temporary seeding on construction sites.

Applications

Temporary seeding should be considered as slope protection and erosion control practice for construction sites. Permanent seeding should be considered for any disturbed area where all construction or maintenance activities have ceased or been finalized and is now ready for permanent vegetative cover. Typical areas subject to permanent vegetative cover are all areas disturbed by new construction, reconstruction and maintenance, and materials source site and areas in need of revegetation.

The primary advantages of seeding are:

- It establishes good soil stabilization.
- It prevents soil erosion and sedimentation.
- It contains and filters stormwater runoff.

Additional advantages specific to permanent seeding are:

- It provides wildlife ground cover and habitat.
- It competes with undesirable vegetation and noxious weeds.
- It provides aesthetic qualities.
- It reduces the cost of maintenance.

Limitations

Drainage area – unlimited
Minimum bedrock depth – 2 ft
NRCS soil type – N/A
Drainage/flood control – no
Maximum slope – 5%
Minimum water table – 2 ft
Freeze/thaw – fair

Permanent vegetative ground cover will take several years before sufficient establishment takes place. Establishment will occur quicker in high precipitation areas, usually over 20 in., as opposed to the arid or semi-arid regions of the state. Permanent seeding should be conducted in conjunction with various forms of mulching, matting, and annual grass (cereal grain) as a nurse crop.

Other factors that contribute to the success or failure of permanent seeding are:

- Seeding should be done at the proper time of year.
- Proper application of fertilizers as prescribed will contribute to the success of the seeding.
- Once seeded, the site should not be disturbed.
- Irrigation may have to be used in low precipitation area (arid/semi-arid) for establishment.

Targeted Pollutants

Sediment
Phosphorus
Trace metals

Design Parameters

Conduct all permanent seeding and fertilizing in accordance with local requirements. See Volume 4, Appendix C, Stormwater Plant Materials for additional guidelines.

Construction Guidelines

Permanent seeding is the last phase of reclaiming any disturbed soils.

Maintenance

- Inspect all seeded areas on a regular basis and after each major storm event to check for areas where corrective measures may have to be made.
- Indicate which areas need to be reseeded or where other remedial actions are necessary to assure establishment of permanent seeding.
- Continue monitoring of the site/area until permanent vegetation is established.

Fiber Rolls BMP 35

Description

A fiber roll (wattle/compost-filled socks) consists of straw, flax, or other similar materials bound into a biodegradable tubular plastic or similar encasing material. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- Along the perimeter of a project
- As check dams in unlined ditches
- Down-slope of exposed soil areas
- Around temporary stockpiles
- As temporary curbs for conveying water to catch basins and pipe slope drains
- For catch basin protection

Limitations

Drainage area – N/A

Maximum slope – See Design Parameters

Minimum bedrock depth – N/A

Minimum water table - N/A

NRCS soil type - ABCD

Freeze/thaw – good

Drainage/flood control – yes

- Fiber rolls are not effective unless trenched.
- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 in. diameter or installations achieving the same protection (i.e., stacked smaller diameter fiber rolls, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls can be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Targeted Pollutants

Sediment

Design Parameters

Locate fiber rolls on level contours spaced as follows:

- Slope inclination of 4:1 or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
- Slope inclination between 4:1 and 2:1: Fiber rolls should be placed at a maximum interval of 15 ft (A closer spacing is more effective.).
- Slope inclination 2:1 or greater: Fiber rolls should be placed at a maximum interval of 10 ft (A closer spacing is more effective.).

Construction Guidelines

- Fiber rolls should be either prefabricated rolls or rolled tubes of erosion control blanket. Field rolled fiber roll is assembled by rolling the length of erosion control blanket into a tube of minimum 8 in. diameter and binding the roll at each end and every 4 ft along the length of the roll with jute-type twine.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into a 2 to 4 in.-deep trench with a width equal to the diameter of the fiber roll. Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center. Use wood stakes with a nominal classification of 0.75 x 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.

Maintenance

- Inspect prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at 2-week intervals during the non-rainy season.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the fiber roll and the adjacent ground surface.
- Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- If fiber rolls are used for erosion control, such as in a mini-check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

Silt Fence BMP 36

Description

A silt fence is a temporary sediment barrier consisting of a filter fabric stretched and attached to supporting posts. Wire fence backing is necessary with several types of filter fabric commonly used. Silt fences assist in sediment control by retaining some of the eroded soil particles and slowing the runoff velocity to allow particle settling.

Applications

- Silt fences can be used near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The fences should remain in place until the disturbed area is permanently stabilized.
- Silt fences can also be used along the toe of fills, on the downhill side of large through-cut areas, along streams, and at natural drainage areas to reduce the quantity of sediment and to dissipate flow velocities to downstream areas.
- Also use at grade breaks on cut/fill slopes and above interceptor dikes.
- The silt fence should be constructed after the cutting and slashing of trees and before excavating haul roads, fill benches, or any soil disturbing construction activity in the drainage areas.

Limitations

Drainage area – 1 ac./100 ft
Minimum bedrock depth – 2 ft
NRCS soil type - ABCD
Drainage/flood control – no
Maximum slope – 33%
Minimum water table – 2 ft
Freeze/thaw – good

Silt fences should not be used where there is a concentration of water in a channel or drainageway or where soil conditions prevent the minimum fabric toe-in depth or minimum depth for installation of support posts. If concentrated flow occurs after installation, take corrective action by placing rock berms or other corrective measures in the areas of concentrated flow.

Targeted Pollutants

Sediment

Design Parameters

- Maximum allowable slope lengths contributing runoff to a silt fence are listed in Table 36-1 below.
- Maximum drainage area for overland flow to a silt fence should not exceed 0.5 ac. per 100 ft of fence.
- Design computations are not required. All silt fences should be placed as close to the contour as possible, and the area below the fence should be undisturbed or stabilized.
- A detail of the silt fence should be shown on the plan, and contain the following minimum requirements:
  - ✓ The type, size, and spacing of fence posts
  - ✓ The size of woven wire support fences
  - ✓ The type of filter cloth used
  - ✓ The method of anchoring the filter cloth

- ✓ The method of fastening the filter cloth to the fencing support
- Where ends of filter fabric come together, they should be overlapped, folded and stapled to prevent sediment bypass.
- Materials:
  - ✓ Silt Fence Fabric: The fabric should meet the specifications in Table 36-2 below, unless otherwise approved by the appropriate erosion and sediment control plan approval authority. Such approval does not constitute statewide acceptance. Statewide acceptability depends on in-field and/or laboratory observations and evaluations.
  - ✓ Fence Posts (for fabricated units): The length should be a minimum of 36 in. long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.0 square in.. Steel posts will be standard "T" and "U" section weighing not less than 1 pound per linear ft.
  - ✓ Wire Fence (for fabricated units): Wire fencing should be a minimum 14.25 gage with a maximum 6 in. mesh opening, or as approved.
  - ✓ Prefabricated Units: Envirofence or approved equal may be used in lieu of the above method providing the unit is installed per manufacturer's instructions.

Construction Guidelines

- Posts should be spaced 10 ft apart when a wire mesh support fence is used and no more than 6.5 ft apart when using extra-strength filter fabric (without a wire fence). The posts should extend at least 16 in. into the ground.
- If standard strength filter fabric is to be used, fasten the optional wire mesh support fence to the upslope side of the posts using heavy duty wire staples, tie wires, or hog rings. Extend the wire mesh support to the bottom of the trench. The filter fabric should then be stapled or wired to the fence.
- Extra strength filter fabric does not require a wire mesh support fence. Staple or wire the filter fabric directly to the posts.
- Do not attach filter fabric to trees.
- Where joints in the fabric are required, splice it together only at a support post, with a minimum 6 in. overlap, and securely seal the joint.
- Embedded filter fabric should extend in a flap that is anchored by backfill, to prevent fabric from pulling out of ground.

Maintenance

Silt fences should be inspected periodically for damage (such as tearing by wind, animals, or equipment) and for the amount of sediment that has accumulated. Remove the sediment when it reaches one-half the height of the silt fence. In situations where access is available, machinery can be used.

Otherwise, the silt should be removed manually. The following are key elements to remember:

- The sediment deposits should be removed when heavy rain or high water is anticipated.
- The sediment deposits should be placed in an area where there is little danger of erosion.

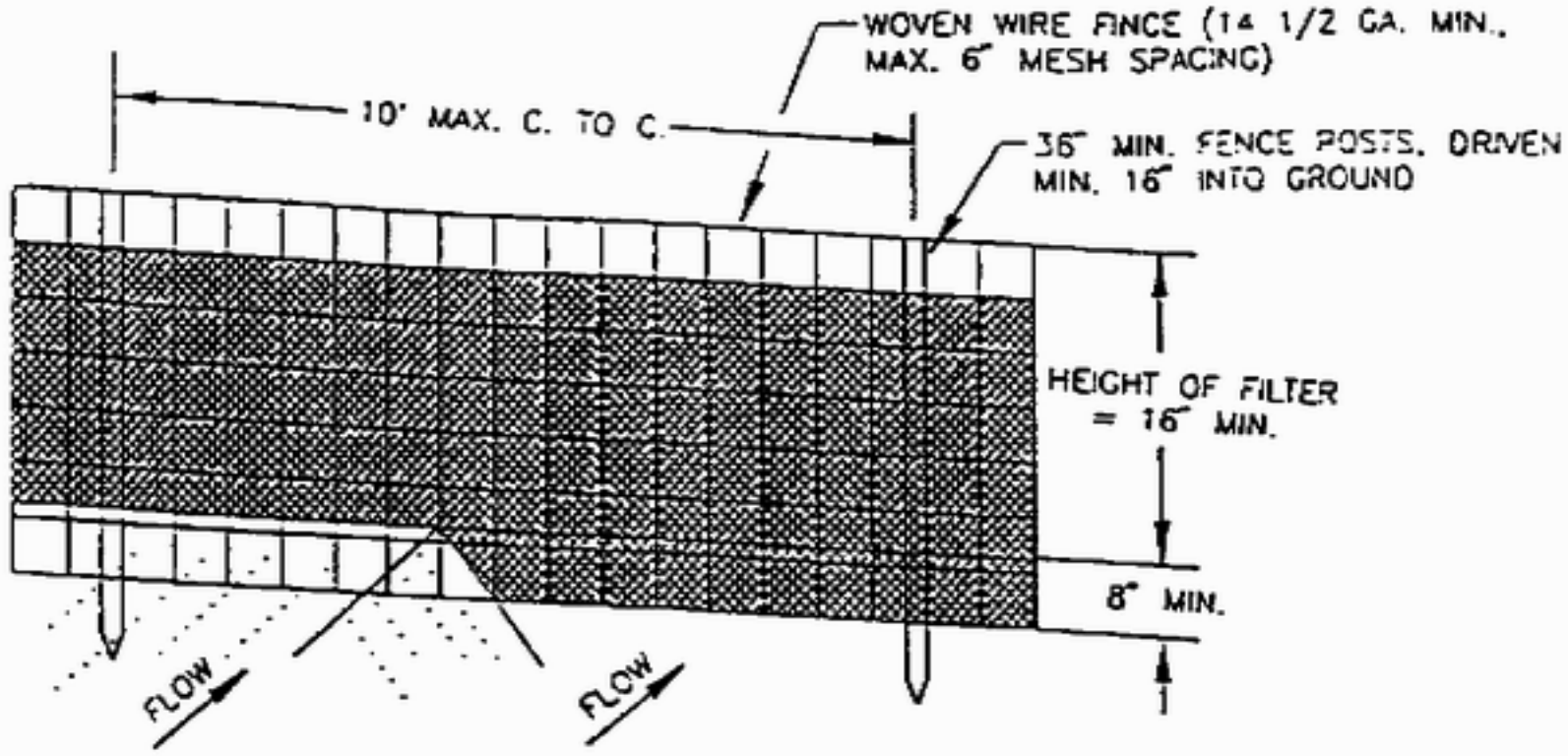
- The silt fence should not be removed until adequate vegetative growth ensures no further erosion of the slopes. Generally, the fabric is cut at ground level, the wire and posts are removed, then the sediment is spread, seeded, and protected (mulched) immediately.

Table 36–1. Maximum Allowable Slope Lengths

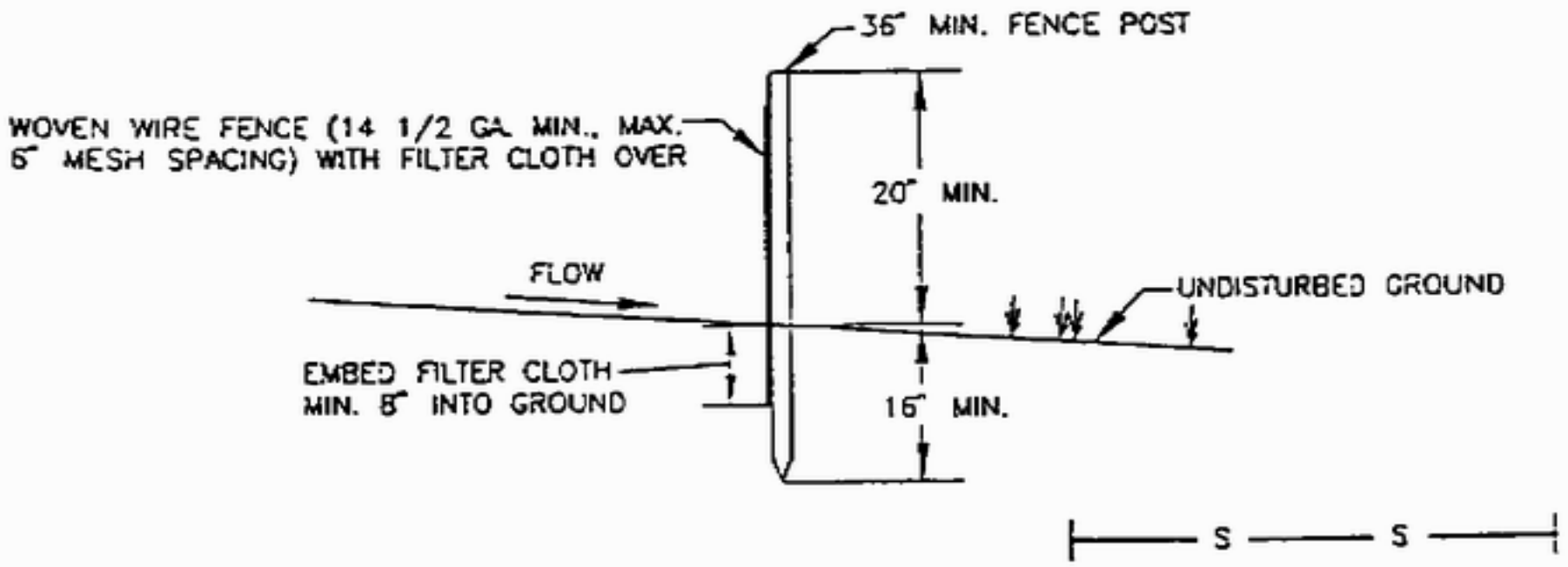
Slope Steepness	Maximum Slope Length (Feet)
2:1	50
3:1	75
4:1	125
5:1	175
Flatter than 5:1	200

Table 36-2. Filter Fabric Specifications

Fabric Properties	Value	Minimum Acceptable Test Method
Grab Tensile Strength (lbs)	90	ASTM D1682
Elongation at Failure (%)	50	ASTM D1682
Mullen Burst Strength (PSI)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTM D751 (modified)
Equivalent Opening Size	40-80	US Std Sieve CW-02215
Ultraviolet Radiation Stability %	90	ASTM-G-26



PERSPECTIVE VIEW



SECTION

STANDARD SYMBOL

CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

1 WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.

2 FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24 INCHES AT TOP AND MID-SECTION.

3 WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6 INCHES AND FOLDED.

4 MAINTENANCE SHALL BE PREFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

POSTS: STEEL, EITHER "T" OR "U" TYPE OR 2" HARDWOOD.

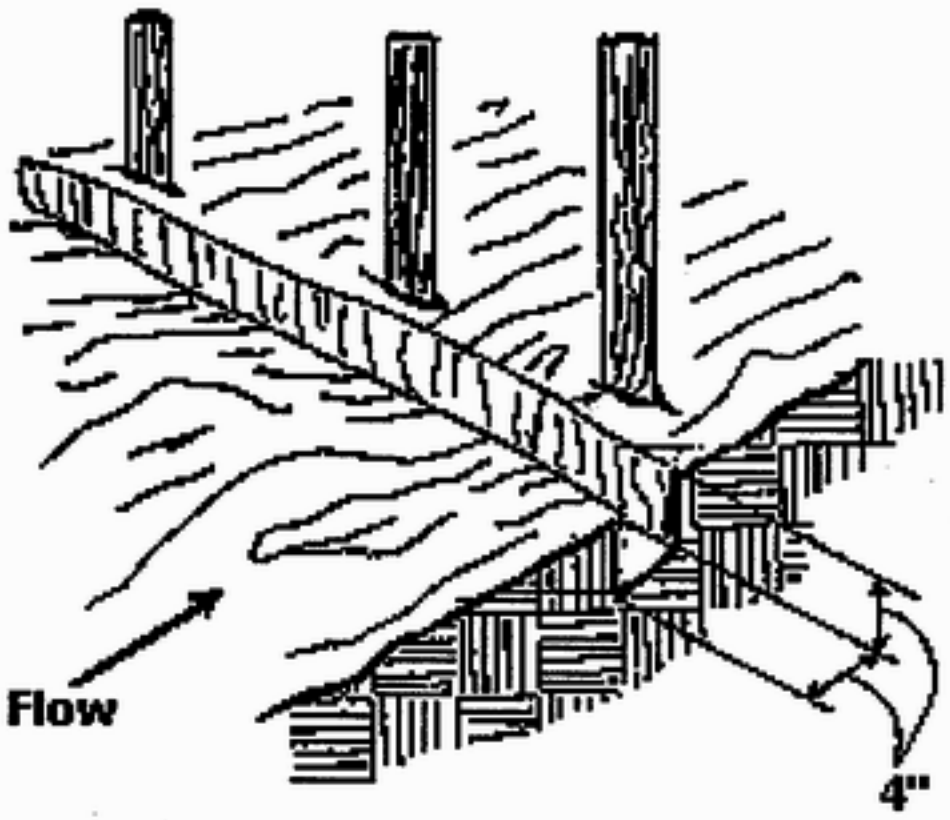
FENCE: WOVEN WIRE, 14 GAGE, 6" MAX. MESH OPENING.

FILTER CLOTH: FILTER X, MIRAFI 100X, STABILINKA T140N OR APPROVED EQUAL.

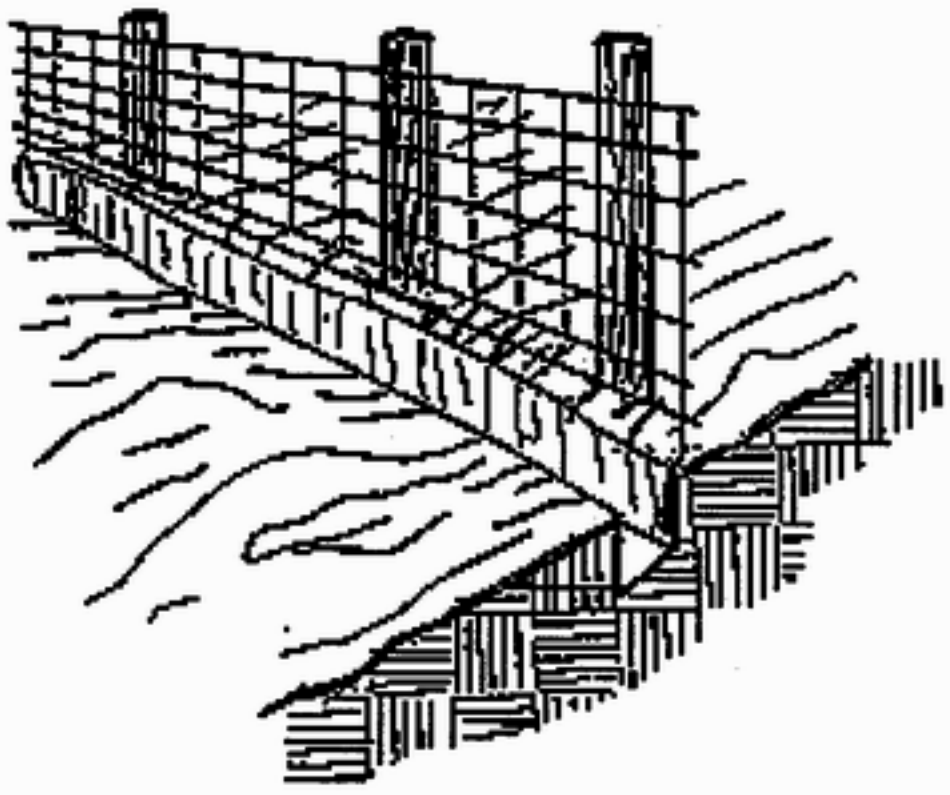
PREFABRICATED UNIT: GEOFAB, ENVIROFENCE OR APPROVED EQUAL.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	SILT FENCE	STANDARD DRAWING
TOOTHMAN-ORTON ENGINEERING COMANY BOISE, IDAHO McCALL, IDAHO		SF-1

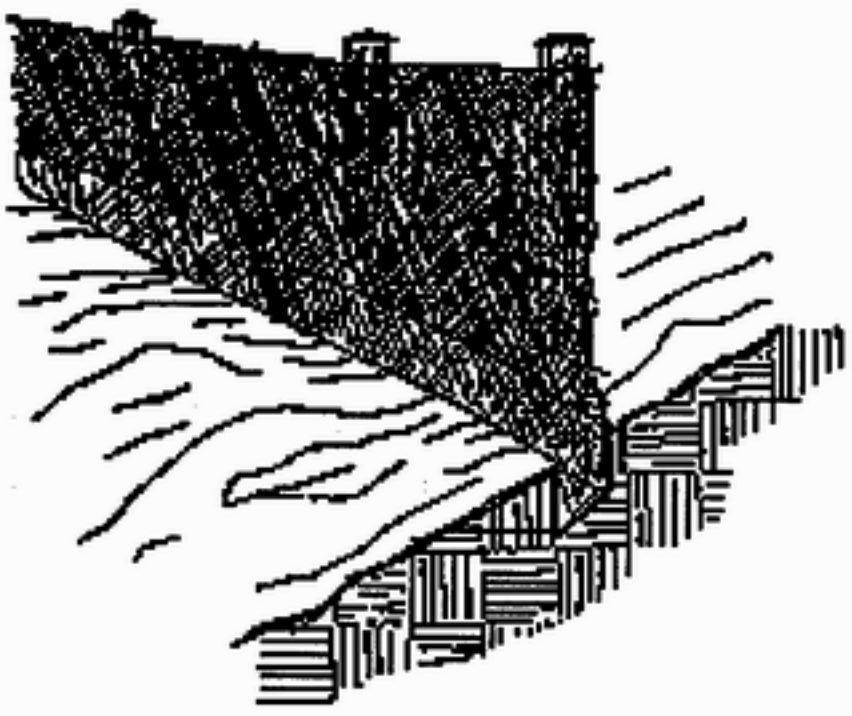
1. **Set Posts and Excavate a 4" x 4" Trench upslope along the line of the posts.**



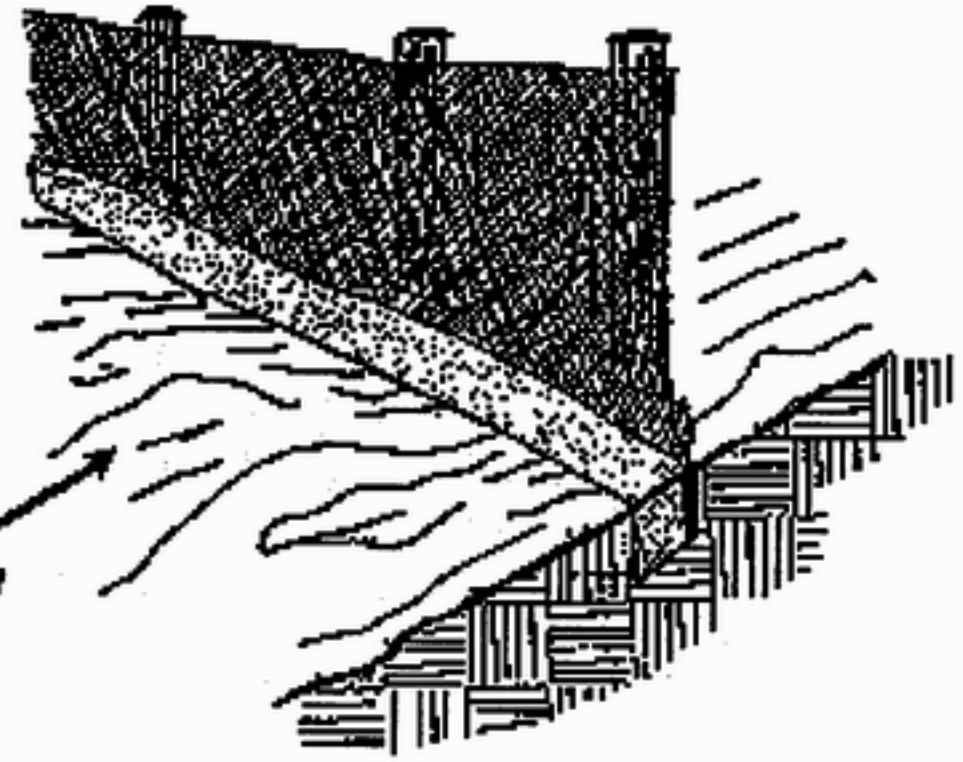
2. **Staple Wire Fencing to the Posts.**



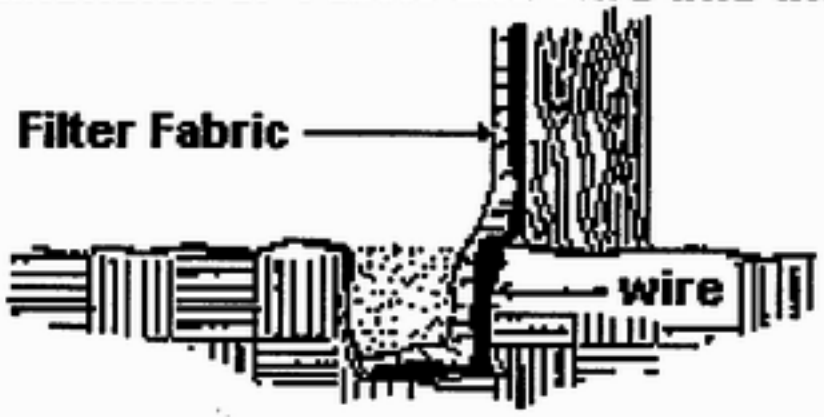
3. **Attach the Filter Fabric to the Wire Fence and Extend it into the Trench.**



4. **Backfill and Compact the Excavated Soil**



Extension of Fabric and Wire into the Trench



Vegetative Buffer Strip BMP 37

Description

A vegetative buffer strip is a gently sloping area of vegetative cover that runoff water flows through before entering a stream, storm sewer, or other conveyance. The buffer strip may be an undisturbed strip of natural vegetation or it can be a graded and planted area.

Vegetative buffer strips act as living sediment filters that intercept and detain stormwater runoff. They reduce the flow and velocity of surface runoff, promote infiltration, and reduce pollutant discharge by capturing and holding sediments and other pollutants carried in the runoff water. Vegetative buffer strips function much like vegetated or grassed swales. Buffer strips, however, are fairly level and treat sheet flow across them, whereas grassed swales are indentations that treat concentrated flows running along them (see BMP 40-Temporary Swale).

Applications

- Used for temporary or permanent control, usually in conjunction with other sediment collection and slope protection practices. Consider use with level spreaders or diversion measures such as earth dikes (BMP 41) and slope drains (BMP 24). Also, silt fences (BMP 36) installed upgradient can prevent overloading of the buffer strip.
- May be placed at many locations between the source of sediment (road surface, side slopes) and a natural or constructed waterway. They are inexpensive and easily constructed, and can be put into place at any time if climatic conditions allow for planting.
- May be used at almost any site that can support vegetation, but is best suited for areas where the soils are well drained or moderately well drained and where the bedrock and the water table are well below the surface.
- Provides low to moderate treatment of pollutants in stormwater while providing a natural look to a site.
- Can provide habitat for wildlife.
- Can screen noise and views if trees or high shrubs are planted on the filter strips.

Limitations

Drainage area - unlimited
Minimum bedrock depth – 5 ft
NRCS soil type – ABCD
Drainage/flood control – no
Maximum slope – 20%
Minimum water table – 3 ft
Freeze/thaw – fair

- Not effective for filtering high velocity flows from large paved areas, steep slopes, or hilly areas. Consider other measures if slopes exceed 15%.
- Requires significant land space.
- May have a short useful life due to clogging by sediments and oil and grease.
- Do not use planted or seeded ground as a buffer strip for sediment trapping until the vegetation is well established.

Targeted Pollutants

Sediment

Design Parameters

- A buffer strip should be at least 20 ft wide to function well. Along live streams or above wetlands, the minimum width should be 100 ft. The length of the strip should be approximately 50 to 82 ft. Where slopes become steeper, increase the length of the strip.
- Tall, dense stands of grass form good sediment traps, as do willows and alder. The willows and alder can be native or planted. A combination of grasses with willows or alder is also effective. Any planted species should be deep rooted and able to adjust to low oxygen levels. Vegetative cover should be at least 75% to assure adequate removal of sediments. Forested strips are always preferred to vegetated strips, and existing vegetation is preferred to planted vegetation. In planning for vegetated strips, consider climatic conditions, since vegetation may not take hold in especially dry and/or cold regions.
- In many cases, a vegetative buffer strip will not effectively control runoff and retain sediments unless employed in conjunction with other control measures. Where heavy runoff or large volumes of sediment are expected, provide diversion measures or other filtering measures above or below the buffer strip.

Construction Guidelines

- Try to direct sediment-laden water onto naturally vegetated or stabilized planted ground.
- Fertilizing seeded or planted ground may enhance growth (and improve its effectiveness as a buffer strip).
- Do not place any equipment, construction debris, or extra soil in the buffer strip (or the strip will be damaged).

Maintenance

- Inspect the buffer strip at regular intervals to ensure proper functioning. Check for damage by equipment and vehicles. In newly planted areas, check the progress of germination and plant growth, and arrange for fertilizing, if needed, to enhance growth and establishment. (Planted ground should not be used for a sediment trap until the vegetation is well established.) Make sure that water flowing through the buffer strip is not causing additional erosion nearby and not forming ponds due to erosion within the buffer strip.
- Buffer strips in natural vegetation do not generally require maintenance; however, on some sites it may be necessary to remove sediments and replant on a regular basis. Promptly repair any damage from equipment, vehicles, or erosion.

Dewatering BMP 46

Description

To assess and appropriately dispose of rising groundwater or rainwater from excavations and other collection areas.

Applications

Public or private properties with the following:

- Foundation work excavations
- Utilities and infrastructure installation and repair projects, including installation, repair and maintenance of:
  - ✓ Electrical conduits
  - ✓ Vaults/tanks
  - ✓ Sewer and storm drain systems
  - ✓ Phone and cable lines
  - ✓ Gas or other fuel lines
- Other excavations or graded areas requiring dewatering

Limitations

Drainage area – N/A
Minimum bedrock depth - N/A
NRCS soil type – N/A
Drainage/flood control – yes
Maximum slope – N/A
Minimum water table - N/A
Freeze/thaw – N/A

Targeted Pollutants

Sediment

Design Parameters

Depending on season, flow rate, volume, or residual contamination, the discharge will be allowed to flow to:

- The ground in a manner that ensures no runoff leaving the site. This may require a permit or other authorization from the local drainage authority.
- The storm drain system. A permit or letter of authorization with discharge restrictions may be required.
- The sanitary sewer. A permit or letter of authorization with discharge restrictions may be required.

The site should be assessed for the issues listed below to assist the local drainage authority in determining which discharge option to approve:

- Water clarity. If the water is cloudy or turbid, there are dissolved and/or settable solids in the water that should be filtered or settled out prior to discharge. Determine if contaminants are present in impounded water. Check for odors, discoloration, or oily sheen. Check any soils and/or groundwater testing results.
- If contamination may be or is present, a certified laboratory should test the proposed discharge waters with results submitted to the local drainage authority. Sampling and testing requirements will be determined on a case-by case basis depending on site history or suspected pollutants. Contact DEQ or the local authority responsible for receiving system before testing to get assistance in identifying the required parameters of concern and any specific sampling requirements. After review, the local drainage authority will specify if any pretreatment is required prior to discharge.

Construction Guidelines

Sediment should be settled prior to discharge. All settling systems should be engineered and adequately sized for site conditions. In general settling and filtering options include the following:

- Containment in a pond structure for a minimum of 4 hours or until water is clear. Place pump in a gravel bed at bottom of pond.
- Pumping to a settling tank with sampling ports
- Filtering through a sieve or other filter media (swimming pool filter). Simple on-site filter systems can be constructed including: wrapping the ends of the suction and discharge pipes with filter fabric; discharging through a series of drums filled with successively finer gravel and sand; and other filtering techniques like those described in the inlet protection section.
- Manufactured bags, polymers, or other systems. These systems do not always work on fine clay soils, and will only be allowed for use where approved. Chemical treatments should have state approval before they are used.

- The flow path should be lined or protected in some way to prevent mobilization of additional sediment.

Filtered material should be either dried and reused on site in a mixture with other site soils or should be appropriately disposed of based on nature and levels of any contaminants present.

Maintenance

- Remember to check filtering devices frequently to make sure they are unclogged and operating correctly. Adjustments may be needed depending on the amount of sediment in the water being pumping.
- Systems should be filled in or otherwise removed when permanent dewatering controls are in place and connected to an approved treatment and receiving system.

APPENDIX B

ARMY CORP OF ENGINEER 404 PERMIT CONDITIONS OF APPROVAL